



Course Specification

Diploma

Course Title: **Microfossils**

Course Code: **APMQ2210**

Program: **Mining and Quarrying**

Department: **Diploma Department**

College: **The Applied College**

Institution: **Umm Al-Qura University**

Version: **1**

Last Revision Date: **20 February 2025**



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A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (2)
(2nd. Level)

4. Course General Description:

This course includes emphasis on collecting and preparing microfossils, how to identify microfossils. Systematic study of microfossils. It is an introductory survey of the major groups of microfossils, including calcareous, siliceous, phosphatic and organic-walled types (foraminifera, ostracods, pteropods, calcareous nannofossils, radiolarians, diatoms, conodonts, etc.).

The skeletal anatomy, biology, mode of life, and geologic history of these benthic and planktic, marine and nonmarine organisms are to be reviewed. Applications of micropaleontology to biostratigraphy, paleoecology, paleoceanography, paleoclimatology and environmental geology. Major mass extinction events. Practical studies of the different fossil groups under the microscope in terms of morphology and structure.

Microfossils are used in a variety of incredibly important ways. One of the most common uses of microfossils is in dating rocks and reconstructing ancient environments. This information is used by geologists and also by people working in mining exploration fields, to locate underground oil reserves and help engineers determine the best way to mine for oil.

The objective of the course consists in learning to identify a number of microfossil groups useful in Geosciences.

5. Pre-requirements for this course (if any):

None

6. Co-requisites for this course (if any):

None

7. Course Main Objective(s):

1. Introduction to Micropaleontology:
Overview of Micropaleontology principles and its relevance to advanced geological studies.

2. History and Growth of Micropaleontology:
Discussion on the historical significance of microfossils and their increasing role in geology.



3. Defining Microfossils:

Microfossils' significance in geology, classification based on shell composition, and their systematic study.

4. Microfossils Diversity:

Various microfossil groups from all kingdoms of life and their applications in geological interpretations.

5. Foraminifera:

Characteristics and ecological significance of foraminifera, including their fossil record and size range.

6. Ostracoda and Pteropods:

Overview of Crustaceans and marine gastropods, their environments, and fossil record significance.

7. Radiolaria and Silico-flagellates:

Study of radiolarians and silico-flagellates, their environmental distributions and fossil utilization.

8. Dinoflagellates and Acritarchs:

Introduction to dinoflagellates and acritarchs as important organic microfossils in paleoecological studies.

9. Spores and Pollens:

Importance of spores and pollens in sedimentary geology, their preservation, and their ecological significance.

10. Sample Collection Techniques:

Differences in collecting microfossil samples from outcrops and subsurface, including drilling methods.

11. Recent Sampling Methods:

Methods for collecting recent sediments and determining the viability of microfossils in biological studies.

12. Microfossils Extraction Methods:

Detailed procedures for separating microfossils from matrices using mechanical and chemical techniques.

13. Microfossils in Exploration:

Application of microfossils in petroleum and mining geology, focusing on biostratigraphy and paleoenvironmental analyses.



2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	30
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

1.0	Knowledge and understanding			
1.1	know the different applications of the main groups of microfossils in geology. In particular, paleoecological, biostratigraphic, biogeographic and evolutionary applications.	K1	Lectures and Interactive Discussions	Written Exams (Mid-Term and Final Exams), Quizzes.
1.2	recognize the main groups of microfossils in hand and microscopic samples and know the main micropaleontological techniques for the extraction and study of microfossils.	K2	Lectures and Interactive Discussions	Written Exams (Mid-Term and Final Exams), Quizzes.
1.3	know the processes of taxonomic alteration of the different groups of microfossils and their interpretation at the moment of evaluating the information in the deposit or sample.	K4	Lectures and Interactive Discussions	Written Exams (Mid-Term and Final Exams), Quizzes.
2.0	Skills			



2.1	The students will acquire some basic skills that will help to recognize major microfossil groups.	S1	Interactive Discussions	Written Exams (Mid-Term and Final Exams), Quizzes
2.2	The students will Understand and familiarize themselves with the most important and discriminatory morphological characters proper to each fossil group.	S2	Interactive Discussions	Written Exams (Mid-Term and Final Exams), Quizzes
3.2	Learn how the microfossils can make significant contributions in a wide range of scientific problems in Geosciences, Environmental and mining explorations.	S3	Interactive Discussions	Written Exams (Mid-Term and Final Exams),
3.0	Values, autonomy, and responsibility			
3.1	Understanding of how microfossils data and information achieved from this endeavour can be utilised with other gathered geological data to optimise its use.	V1	Individual and Group Presentations	Presentations

C. Course Content

No	List of Topics	Contact Hours
1.	Fundamentals of the Micropaleontology: (Concept, history and methods of Micropaleontology, Taphonomy and micropaleontological classification).	2
2.	Main micropaleontological groups: (Foraminifers, Planktic Foraminifera, Radiolaria, Tintinnids and calcareous nannofossils, Diatoms and other microfossils of protists and invertebrates).	2
3.	Applications of Micropaleontology: (Paleoecology and paleoenvironmental reconstruction using microfossils).	2
4.	Methods of stratigraphic correlation using microfossils.	2
5.	Using microfossils for paleoenvironmental understanding.	2
6.	Reconstruction of paleobiological, paleoclimatic and paleoceanographic events using microfossils.	2
7.	Origin and history of life during the Precambrian through microfossils. Astrobiology using microfossils.	2





8.	Biostratigraphy, limits and advantages of microfossils.	2
9.	Marine vs non-marine microfossils.	2
10.	Definition of water depth from various fossil groups.	2
11.	The identification of sequence boundaries using biostratigraphical Data.	2
12.	Integrated Biostratigraphy and its use in Play based exploration techniques.	2
13.	Microfossils Extraction Methods.	2
14.	Utility of microfossils in exploration	2
15.	Fossil groups under the microscope.	2
Total		30

C.2 Experimental Content

No	List of Topics	Contact Hours
1.	Lab 1: Microscopy Basics	2
2.	<ul style="list-style-type: none"> Handling stereo and compound microscopes Slide preparation and staining techniques Lab 2: Sampling and Sieving <ul style="list-style-type: none"> Techniques for extracting microfossils from sediment samples (wet and dry sieving) Grain size separation 	2
3.	Types and Classification of Microfossils	2
4.	<ul style="list-style-type: none"> Lab 3: Calcareous Microfossils <ul style="list-style-type: none"> Observation of Foraminifera and Coccolithophores under the microscope Identification using morphological keys Lab 4: Siliceous Microfossils <ul style="list-style-type: none"> Diatoms and Radiolarians Sample preparation with acid treatments 	2
5.	<ul style="list-style-type: none"> Lab 5: Organic-walled Microfossils <ul style="list-style-type: none"> Palynology: Pollen and Spores Kerogen separation techniques 	2
6.	Module 3: Paleoenvironmental Interpretation <ul style="list-style-type: none"> Lab 6: Microfossil Assemblage Analysis <ul style="list-style-type: none"> Relative abundance counting 	2





	<ul style="list-style-type: none"> Interpreting past environments based on assemblage composition 	
7.	<ul style="list-style-type: none"> Lab 7: Isotopic and Geochemical Methods <ul style="list-style-type: none"> Introduction to stable isotope analysis (e.g., $\delta^{18}O$, $\delta^{13}C$ in Foraminifera) Correlation to paleoclimate data 	2
8.	Module 4: Biostratigraphy and Age Dating <ul style="list-style-type: none"> Lab 8: Stratigraphic Range Charts <ul style="list-style-type: none"> Creating and interpreting microfossil range charts Zonation schemes (e.g., Planktonic Foraminiferal Zones) 	2
9.	<ul style="list-style-type: none"> Lab 9: Core Sampling and Microfossil Dating <ul style="list-style-type: none"> Study of microfossils from drill cores or borehole samples Correlating core data with known biozones 	2
10.		2
11.	Module 5: Applied Micropaleontology	2
12.	Lab 10: Microfossils in Petroleum Exploration <ul style="list-style-type: none"> Case studies using microfossils for age-dating and environmental reconstruction 	2
13.	Lab 11: Quantitative Analysis with Software <ul style="list-style-type: none"> Using software like ImageJ or PaleoTax for measuring and analyzing microfossil morphology 	2
14.	Database building and statistical interpretation	2
Total		28

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	5	10
2.	Mid-Term Exam	8	20
3.	Presentations	12	10
4.	Homework	All weeks	10
5.	Final Exam	16	50

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources





Essential References	<p>Blome, C. E., Whalen, P. M., and Reed, K. M. (Convenors). 1995 - Siliceous Microfossils. Short Courses in Paleontology Number 8. Paleontological Society.</p> <p>Brasier, M. D. 1980 – Microfossils, Brief overview of major groups of microfossils. Simple drawings of each kind of microfossil.</p> <p>Boardman, R. S., Cheetham, A. H. and Rowell, A. J. (Editors). 1987 - Fossil Invertebrates. Blackwell Science, An advanced college-level text on fossil invertebrates with excellent descriptions and good illustrations.</p>
Supportive References	<p>Brasier, G. 1980 - Microfossils. George Allen & Unwin. Londres. 193 pp.</p> <p>Haq, B.U. & Boersma, A. Ed. 1978 - Introduction to marine Micropaleontology (reed. 1998). Elsevier. Nueva York. 376 pp.</p> <p>Molina, E. (Ed.) 2002 - Micropaleontología. Prensas Universitarias de Zaragoza. Zaragoza, 634 pp.</p> <p>Sweet, W. C 1988 - The Conodonta. Morphology, Taxonomy, Paleoecology, and Evolutionary History of a Long-Extinct Animal Phylum. Oxford Monographs on Geology and Geophysics 10, 224 p., 96 Text- Figs., 13</p>
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	



F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty	Direct (project, HW, Quiz, midterm and final exam)
Effectiveness of Students assessment	Students	Indirect (Student Survey)
Quality of learning resources	Program Coordinator	Direct analysis
The extent to which CLOs have been achieved	Program Coordinator	Direct analysis
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
REFERENCE NO.	851110214476/195605
DATE	18/2/1447

